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Surface passivation effects on the performance of p-planar HPGe radiation detector[1] MUHAMMAD KHIZAR, GUOJIAN WANG, DONGMING MEI, University of South Dakota, South Dakota, USA — Surface passivation of HPGe detectors are always critical to reduce or eliminate the surface effects responsible for limiting both the leakage current and breakdown voltages of these devices. Among the critical part of any HPGe detector is the intrinsic surface, where the full bias voltage is applied at 77K. Typically, in order to make these surfaces electrically passive, and to avoid surface leakage currents, a thick layer of SiO2 is deposited by using different high temperature dry/wet deposition techniques. However, surface passivation using such techniques can result modifying the electric field, by compromising the charge collection in the volume near the contact surfaces. Another option is the amorphous germanium (a-Ge), which acts as a passivant as well as bi-polar blocking contacts. In this study, we have designed a controlled experiment to use Ge oxidation contact as a passivation layer by testing the electrical behavior of the crystal after each oxidation treatment. For this, a high quality a-Ge layer ($\sim$ 100 nm to 150 nm) is deposited at 1.5x10^6 torr using low temperature RF plasma sputtering deposition technique. Among the key characteristics of the deposited passivation layer includes the depositions rates, the precursors (pre-mixed (H2 $\sim$ 15% and Ar) flow rates, plasma power, chamber pressure, and target to-substrate distance. We show the results from our study using home grown HPGe crystals at USD.

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